

# RESERVE COPY

## PATENT SPECIFICATION

580,916



Application Date: Nov. 20, 1944. No. 23078/44.

Complete Specification Left: Nov. 16, 1945.

Complete Specification Accepted: Sept. 24, 1946.

### PROVISIONAL SPECIFICATION

#### Protection of Refractory Material and Metals in Contact with Molten Aluminium

I, FELIX SINGER, British subject, of Keramos House, 46, Castlemaine Avenue, South Croydon, Surrey, do hereby declare the nature of this invention (which has been communicated to me by Josef M. Lucas, a citizen of Czecho-Slovakia, of 1758 10th Street, Cuyahoga Falls, Ohio, United States of America), to be as follows:—

10 This invention relates to protective coatings for refractory material and metals in contact with molten aluminium, the main object of which is to prevent contamination of the aluminium whereby its composition and properties would be affected. The invention is accordingly intended to be applied not only to furnaces or vessels in which molten aluminium is fused but also to accessories and devices associated with the melting apparatus which come into contact with the molten metal.

The melting of aluminium is carried out in various types of furnaces, e.g. reverberatory furnaces, rotary furnaces and crucible furnaces, and it is customary to line with refractory material the surfaces which come into contact with the molten aluminium. Generally however the tubes or the like which serve as an outlet for the molten aluminium are constructed of iron and the latter is also used as a structural material for the manufacture of crucibles, ladles, thermocouple sleeves and other devices used in conjunction with the melting of aluminium.

For the lining of the furnaces or the like ceramic refractories are normally used but such material is liable to attack by the fused aluminium with the result that impurities are introduced into the fused metal. Moreover, fused aluminium in contact with iron dissolves the latter and thus entrains contaminating material.

Various methods of coating ceramic refractories and iron have been employed but these have had to be regarded as not having proved entirely satisfactory. The present invention provides a protective coating which is believed to be more effective.

The process according to the invention for protecting refractory material and iron or other metal when in contact with molten aluminium comprises applying to the surface of such material or metal a coating comprising calcined aluminosilicate or silicates, or substances producing the same on heating, a carbonate or sulphate of a metal of the second group of elements of the periodic system, and sodium silicate or potassium silicate. Such coating composition may be applied as an aqueous slurry by spraying, brushing or other like means. After application of the coating the latter is dried and heated, but it is not generally necessary to perform such operations specially for the purpose for they may be left to take place by the molten aluminium during the actual use of the apparatus which is concerned.

The aluminosilicates may be provided by various materials such as calcined kyanite, sillimanite, andalusite or other grog customarily used for ceramic purposes, or other burnt refractories. One of the functions of the aluminosilicates is to prevent excessive shrinkage of the coating during drying and heating.

Whiting is particularly suitable as the carbonate ingredient but this may be replaced by barium carbonate, strontium carbonate, magnesium carbonate, dolomite or similar carbonates, or by the corresponding sulphates.

The coating composition may be supplied already in a liquid state or as a dry mixture ready to be mixed with water to reduce it to the required fluid condition for application.

As an illustration of the invention by way of example, calcined kyanite graded to pass a 200 mesh sieve, and whiting, as generally used for ceramic purposes, are mixed in proportions by weight of 2:1. The mixture is ground in a ball mill with 32° Bé silicate of soda to a thin slurry capable of being sprayed or brushed on firebricks, insulating bricks, or other ceramic refractory material, or of metal.

The very finely ground kyanite (200 mesh) can be replaced by coarser material

passing say a 35 mesh and the coating will still prevent the penetration of fused aluminium into firebrick and insulating brick.

Dated this 20th day of November, 1944.  
CARPMAELS & RANSFORD,  
Agents for Applicant,  
24, Southampton Buildings,  
London, W.C.2.

## COMPLETE SPECIFICATION

### Protection of Refractory Material and Metals in Contact with Molten Aluminium

5 I, FELIX SINGER, British subject, of Keramos House, 46, Castlemaine Avenue, South Croydon, Surrey, do hereby declare the nature of this invention (which has been communicated to me by Josef 10 M. Lucas, a citizen of Czecho-Slovakia, of 1758 10th Street, Cuyahoga Falls, Ohio, United States of America), and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to protective coatings for refractory material and metals in contact with molten aluminium, the main 20 object of which is to prevent contamination of the aluminium whereby its composition and properties would be affected. The invention is accordingly intended to be applied not only to furnaces or vessels 25 in which molten aluminium is fused but also to accessories and devices associated with the melting apparatus which come into contact with the molten metal.

The melting of aluminium is carried 30 out in various types of furnaces, e.g. reverberatory furnaces, rotary furnaces and crucible furnaces, and it is customary to line with refractory material the surfaces which come into contact with the molten 35 aluminium. Generally however the tubes or the like which serve as an outlet for the molten aluminium are constructed of iron and the latter is also used as a structural material for the manufacture of crucibles, 40 ladles, thermocouple sleeves and other devices used in conjunction with the melting of aluminium.

For the lining of the furnaces or the like ceramic refractories are normally used but 45 such material is liable to attack by the fused aluminium with the result that impurities are introduced into the fused metal. Moreover, fused aluminium in contact with iron dissolves the latter and 50 thus entrains contaminating material.

Various methods of coating ceramic refractories and iron have been employed but these have to be regarded as not having proved entirely satisfactory. The present 55 invention provides a protective coating which is believed to be more effective.

The process according to the invention for protecting refractory material and iron or other metal when in contact with molten aluminium comprises applying to the surface of such material or metal a coating 60 comprising calcined aluminosilicate or silicates, or substances producing the same on heating, a carbonate or sulphate of a metal of the second group of elements of the periodic system, and sodium silicate or potassium silicate. Such coating composition may be applied as an aqueous slurry by spraying, brushing or other like 65 means. After application of the coating the latter is dried and heated, but it is not generally necessary to perform such operations specially for the purpose for they may be left to take place by the molten aluminium during the actual use of the 70 apparatus which is concerned.

The aluminosilicates may be provided by various materials such as calcined kyanite, sillimanite, andalusite or other 75 grog customarily used for ceramic purposes, or other burnt refractories. One of the functions of the aluminosilicates is to prevent excessive shrinkage of the coating during drying and heating.

Whiting is particularly suitable as the 80 carbonate ingredient but this may be replaced by barium carbonate, strontium carbonate, magnesium carbonate, dolomite or similar carbonates, or by the corresponding 85 sulphates.

The coating composition may be supplied already in a liquid state or as a dry mixture ready to be mixed with water to 90 reduce it to the required fluid condition for application.

As an illustration of the invention by way of example, calcined kyanite graded to pass a 200 mesh sieve, and whiting, as 95 generally used for ceramic purposes, are mixed in proportions by weight of 2:1. The mixture is ground in a ball mill with 32° Bé silicate of soda to a thin slurry capable of being sprayed or brushed on 100 firebricks, insulating bricks, or other ceramic refractory materials, or on metal.

The very finely ground kyanite (200 mesh) can be replaced by coarser material 105 passing say a 35 mesh and the coating will

still prevent the penetration of fused aluminium into firebrick and insulating brick.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Process for protecting refractory material and metals when in contact with molten aluminium which comprises applying to the surface of such material or metal a coating comprising calcined alumino silicate or silicates, or substances producing the same on heating, a carbonate or sulphate of a metal of the second group of elements of the periodic system, and sodium silicate or potassium silicate.

2. Process as claimed in claim 1 in which the coating is applied as an aqueous slurry.

3. Process as claimed in claims 1 or 2 in which the alumino silicates are provided by calcined kyanite, sillimanite, andalusite or other grog customarily used for ceramic purposes.

4. Process as claimed in claims 1, 2 or 3 in which whiting is used as the carbonate ingredient.

Dated this 16th day of November, 1945.

CARPMAELS & RANSFORD,  
Agents for Applicant,  
24, Southampton Buildings,  
London, W.C.2.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1946. Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 1s. 0d. each (inland) 1s. 1d. (abroad) may be obtained.